## **PartB**

## 2. (40 points) Write the following queries (in SQL only), based on the database schema

(a) Give the manufacturer and speed of laptops with a hard disk of at least thirty gigabytes

```
SELECT DISTINCT
Product.maker, Laptop.speed
FROM
Product,
Laptop
WHERE
Product.model = Laptop.model
AND laptop.hd >= 30;
```

| maker | speed |
|-------|-------|
| E     | 2.00  |
| E     | 1.73  |
| E     | 1.80  |
| Α     | 2.00  |
| Α     | 2.16  |
| В     | 1.83  |
| F     | 1.60  |
| G     | 2.00  |

Select \*

(b). Find the model number and price of all products (of any type) made by manufacturer B

```
from

(select model, price
from product natural join pc
where maker = "B")T1

Union
(select model, price
from product natural join laptop
where maker = "B")

Union
(select model, price
from product natural join printer
where maker = "B")
```

Output:

| model * | price * |
|---------|---------|
| 1004    | 649     |
| 1005    | 630     |
| 1006    | 1049    |
| 2007    | 1429    |

(c) Find those manufacturers that sell Laptops, but not PC's.

```
SELECT DISTINCT

maker

FROM

Product

WHERE

type = 'laptop'

AND maker NOT IN (SELECT maker

FROM

Product

WHERE

type = 'pc');
```

maker F G

(d). Find those hard-disk sizes that occur in two or more PC's

select A.hd from pc A inner join pc B on A.hd = B.hd and A.model < B.model



(e) Find those pairs of PC models that have both the same speed and RAM. A pair should be listed only once; e.g. list (i,j) but not (j,i)

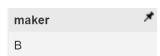
```
SELECT
PC1.model, PC2.model
FROM
PC PC1,
PC PC2
WHERE
PC1.model < PC2.model
AND PC1.speed = PC2.speed
AND PC1.ram = PC2.ram;
```

| model | model |
|-------|-------|
| 1004  | 1012  |

(f) Find those manufacturers of at least two different computers (PC's or laptops) with speeds of at least 3.0

```
select T3.maker
from
    select *
    from(
              (select model, speed, maker
              from product
              natural join pc
              where speed \geq 3.0)
              ) T1
         union
              (select model, speed, maker
              from product
              natural join laptop
              where speed \geq 3.0)
         )T2
inner join
    (
    select *
    from(
              (select model, speed, maker
              from product
              natural join pc
              where speed >= 3.0)
              ) T1
         union
              (select model, speed, maker
              from product
              natural join laptop
              where speed \geq 3.0)
         )T3
on T2.maker = T3.maker
and T2.model < T3.model
```

## Output:



(g) Find the makers of PC's with a speed of at least 3.0

SELECT DISTINCT
maker
FROM
Product,

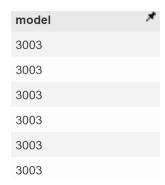
```
PC
WHERE
Product.model = PC.model
AND PC.speed >= 3.0;
```



(h) Find the printers with the highest price
Select t1.model
from
(select p1.\*
from printer p1 inner join printer p2
on p1.price > p2.price)t1
left join
(select q1.\*
from printer q1 inner join printer q2
on q1.price < q2.price)t2</p>

on t1.price = t2.price where t2.price is null

## Output:



(i) Find the laptops whose speed is slower than that of any PC

```
SELECT
Laptop.model
FROM
Laptop,
(SELECT DISTINCT
MIN(speed) AS minspeed
FROM
PC) AS t1
```

```
WHERE
```

Laptop.speed < t1.minspeed;

model

```
(j). Find the model number of the item (PC, laptop or printer) with the highest price.
            Select M1.model
            from
                 (Select P1.model, P1.price
                 from(
                      select *
                      from(Select model, price
                           from product
                           natural join pc)t1
                      union
                           (select model, price
                           from product
                           natural join laptop)
                      union
                           (select model, price
                           from product
                           natural join printer)
                      )P1
                 inner join
                    (
                      select *
                      from
                           (Select model, price
                           from product
                           natural join pc)t2
                      union
                           (select model, price
                           from product
                           natural join laptop)
                      union
                           (select model, price
                           from product
                           natural join printer)
                      )P2
                 on P1.price > P2.price
                 )M1
            left join
```

```
Select *
    from(
         Select P3.model, P3.price
         from
              select *
              from
                   (Select model, price
                   from product
                   natural join pc)t3
              union
                   (select model, price
                   from product
                   natural join laptop)
              union
                   (select model, price
                   from product
                   natural join printer)
              )P3
         inner join
             (
              select *
              from
                   (Select model, price
                   from product
                   natural join pc)t4
              union
                   (select model, price
                   from product
                   natural join laptop)
              union
                   (select model, price
                   from product
                   natural join printer)
                   )P4
         on P3.price < P4.price
         )M2
)MM2
on M1.price = MM2.price
where MM2.price is null
```

model 2001 (k) Find the maker of the color printer with the lowest price

SELECT

Product.maker

FROM

Product,

(SELECT

model, MIN(price) AS min\_price

FROM

Printer

WHERE

color = 1) AS t1

WHERE

Product.model = t1.model



(I). Find the maker(s) of the PC(s) with the fastest processor among all those PC's that have the smallest amount of RAM.

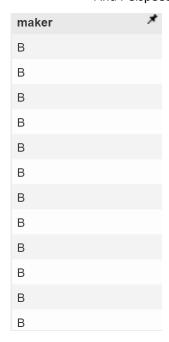
Select
PC.maker

From
PC,
Product

Where PC.model = Product.model

And PC.ram <= (select Min(ram) from PC)

And PC.speed >= (select Max(speed) from PC)



(m) Write a query that will produce information about all products (PC, laptops, and printers) including

their manufacturer if available, and whatever information about that product is relevant (i.e., found in the relation for that type of product).

3. A general form of relational-algebra query is:  $\pi L(\sigma C (R1 \times R2 \times \ldots \times Rn))$  Here, L is an arbitrary list of attributes, and C is an arbitrary condition. The list of relations R1, R2, . . . , Rn may include the same relation repeated several times, in which case appropriate renaming may be assumed applied to the R0 i s. Show how to express any query of this form in SQL.

WHERE C